

# Academic Quarterly



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## Reading Expert

### An Exploration of Instructional Practices that Foster Language Development and Comprehension

*Dale Webster, Ph.D., Chief Academic Officer, CORE, Inc.*

The study *An Exploration of Instructional Practices that Foster Language Development and Comprehension: Evidence from Prekindergarten through Grade 3 in Title I Schools* begins to identify promising instructional practices that improve language development and comprehension in K–3 students. The panel notes, “The evidence indicates that the reading comprehension outcomes of elementary school students are strongly associated with their earlier development of . . . language skills (Kendeou et al., 2009; National Early Literacy Panel, 2008). Therefore, elementary school students who have difficulty reading are very likely to have struggled with early language skills” (p. 1). There have been numerous evaluations of a variety of interventions and programs, including Early Reading First, Reading First, Preschool Curriculum and Evaluation Research Consortium, and Even Start. Unfortunately, these evaluations show that the effects on children’s language and comprehension outcomes have been inconsistent.

The Institute of Education Sciences commissioned this study to identify promising instructional practices to then be prioritized for further study on a large scale. The authors of this report are clear that they are not making recommendations for actual classroom instruction. Instead, the goal of this study is to suggest directions for future research that will better develop young children’s language development and reading comprehension. Beyond the five components of reading, this report focused on practices that will develop young children’s oral language, knowledge of the world, higher-order thinking, understanding of texts, and engagement in the classroom.



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## An Exploration of Instructional Practices that Foster Language Development and Comprehension (cont.)

This study also examined the relationships between instructional practices and student growth in a range of language and comprehension outcomes. The National Early Literacy Panel (2008) determined that a variety of language measures covering a range of skills are more strongly correlated to reading comprehension than measures focused solely on one aspect, such as vocabulary (p. 3). Thus, in addition to a reading comprehension measure, the panel used measures assessing basic language skills, listening comprehension (conceptually the closest to reading comprehension), and background knowledge in science and social studies, “a key input into comprehension” (p. 7), to help create a broader picture of language development and comprehension.



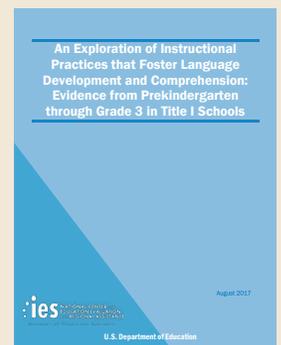
The study identified seven research priorities:

- 1 The effects of vocabulary instruction on a range of language and comprehension outcomes, beyond just vocabulary development
- 2 The relative value of close reading (focusing on the information in a text) versus using prior knowledge more intentionally to promote reading comprehension growth
- 3 The effects of instruction that promotes higher-order thinking on students’ language development and comprehension
- 4 The extent to which focusing on the meaning of texts in reading lessons promotes overall language and comprehension skills, not just comprehension of the specific texts being taught
- 5 The effects of promoting and maintaining instruction in reading comprehension strategies on a large scale
- 6 The effects of encouraging students’ oral language on a range of languages and comprehension outcomes, beyond just oral language skills
- 7 The extent to which the deliberate strategies to teach world knowledge (that go beyond students’ prior knowledge) lead to growth in language and comprehension

The study also encouraged future research to address the ways in which these promising practices have different effects on English learners and students at varying skill levels. You can read the full report [here](#).

### References

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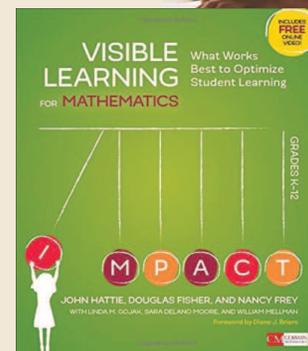
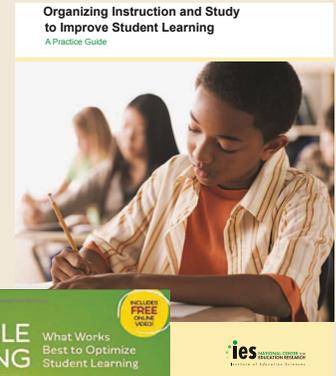
## Techniques for Effective Teaching May Age, but They Do Not Expire, Part 1

Correlations between Hattie, Fisher, and Frey's *Visible Learning for Mathematics* (2017) and the Institute of Education Sciences Guide *Organizing Instruction and Study to Improve Student Learning* (2007)

by Dean Ballard, Director of Mathematics, CORE, Inc.

The Institute of Education Sciences (IES) periodically publishes guides to provide recommendations on key educational topics. The recommendations are based on meta-analyses of relevant research. The IES Guide *Organizing Instruction and Study to Improve Student Learning* (Pashler et al., 2007) lists the following seven recommendations for teachers on strategies to facilitate improved student learning:

1. Space learning over time
2. Interleave worked example solutions with problem-solving exercises
3. Combine graphics with verbal descriptions
4. Connect and integrate abstract and concrete representations of concepts
5. Use quizzing to promote learning
6. Help students allocate study time efficiently
7. Ask deep explanatory questions



These seven recommendations are reinforced in the recent work of John Hattie, Douglas Fisher, and Nancy Frey titled *Visible Learning for Mathematics* (2017). In *Visible Learning for Mathematics*, the authors build on Hattie's 2007 meta-analysis of educational research in *Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement* to provide specific recommendations for teaching K-12 mathematics.

The recommendations in the IES Guide are well worth revisiting and connecting to the recommendations in the work of Hattie, Fisher, and Frey. Techniques for effective teaching may age, but they do not expire. In this article, and in a second article to appear in the next *Academic Quarterly* issue, we highlight selected effective teaching strategies based on conclusions and recommendations from the IES Guide and from Hattie, Fisher, and Frey. This article describes the correlations between Hattie, Fisher, and Frey and the first four recommendations from the IES Guide. Part 2, which will appear in the winter CORE *Academic Quarterly*, describes correlations for the last three recommendations. Included at the end of this article is a chart listing all seven IES recommendations, along with the "level of evidence" rating for each recommendation and the corresponding influential practices from Hattie, Fisher, and Frey, along with the related effect sizes.

A common goal for student learning is to move key ideas, facts, and skills from short-term to long-term memory. But just what are the instructional strategies that do this? It turns out there are some reliable strategies that push information, experiences, and ideas into long-term memory and make these memories readily retrievable. Four key attributes can make memories permanent are rehearsal or practice, novelty, sense-making, and meaningfulness. Questions we should ask are which of these can or cannot be used in classroom instruction, are all or any of these attributes necessary, are all or any of these sufficient, and is there a magic combination—a silver bullet, if you will—or can any combination work?

## Techniques for Effective Teaching May Age, but They Do Not Expire, Part 1 (cont.)

### IES Recommendation #1: Space learning over time

#### Hattie, Fisher, and Frey: Spaced (distributed) vs. massed practice

Hattie, Fisher, and Frey point out that spaced practice “has to do with the frequency of different learning opportunities—having multiple exposures to an idea over several days to attain learning and spacing the practice of skills over a long period of time” (p. 129). This is much more effective than just massing practice at the time a skill or concept is learned.

The IES Guide provides the following recommendations (pp. 4–6):

- Identify key concepts, terms, and skills to be taught and learned (use class time to review key content).
- Arrange for students to be exposed to each main element of material on at least two occasions, separated by a period of at least several weeks—and preferably several months.
- Arrange homework, quizzes, and exams in a way that promotes delayed reviewing of important course content. In other words, assessments include an element of cumulative review.

In a 2015 *Scientific American* article, “The Interleaving Effect: Mixing It Up Boosts Learning,” Steven Pan discusses a recent study on interleaving questions on 7th grade math assignments. He points out that when “both old and new problems of different types were mixed together,” students not only performed 25% better on immediate assessments of knowledge, but also performed 76% better when assessed on those same concepts months later when compared to students who did not receive interleaved assignments.

### IES Recommendation #2: Interleave worked example solutions with problem-solving exercises

#### Hattie, Fisher, and Frey: Worked examples

Besides interleaving practice with recent and past concepts and skills, student work should include worked examples mixed with practice. The IES Guide’s recommendations include the following (p. 4):

- Have students alternate between reading already worked solutions and trying to solve problems on their own.
- As students develop greater expertise, reduce the number of worked examples provided and increase the number of problems that students solve independently.

Both Hattie, Fisher, and Frey and the IES Guide recommend mixing worked examples with similar problems that students immediately complete collaboratively or individually. Hattie, Fisher, and Frey explain that worked examples are best when highlighting the mathematical reasoning involved in solving problems. Worked examples can target specific anticipated misconceptions. Sometimes a worked example that purposely includes an error is useful in getting students to reason about specific parts of a process or solution without students having to create the entire solution themselves. The IES Guide recommends one-to-one interleaving, one worked example with one problem for students to solve, as a technique to use for both classwork and assigned homework.

### IES Recommendation #3: Combine graphics with verbal descriptions

#### Hattie, Fisher, and Frey: Visual aids such as number lines, word walls, and graphic organizers

The IES Guide recommends that the use of visuals, including “figures, charts, video clips, or other graphic formats” (p. 14), be used in combination with verbal explanations to teach key steps in key processes. Number lines are given as another primary example in both the IES Guide and Hattie, Fisher, and Frey for an effective visual tool for learning mathematics. Hattie, Fisher, and Frey also point out the usefulness of word

## Techniques for Effective Teaching May Age, but They Do Not Expire, Part 1 (cont.)

walls and graphic organizers. Word walls provide students with helpful reminders of key terms connected to the concepts they are currently learning. Graphic organizers, such as Frayer Models and anchor charts, are excellent visual displays that demonstrate “relationships between words, facts, concepts, or ideas” (pp. 123–125).

### **IES Recommendation #4: Connect and integrate abstract and concrete representations of concepts Hattie, Fisher, and Frey: Manipulatives, CRA, and visual representations**

Concrete representations include concrete objects or manipulatives, such as blocks, counters, and fraction strips, and visual images of objects and situations, such as tape diagrams and interactive displays (for examples, see <http://www.desmos.com>). These types of representations provide a concrete way of understanding abstract mathematical concepts. Such concrete representations are especially good for developing an initial understanding of a concept, or what Hattie, Fisher, and Frey refer to as “surface learning” (pp. 125–126). However, for students to gain a deeper and transferable understanding, they need to see the connections between the concrete representations and the abstract mathematical representations. Connecting the concrete with the abstract is known in mathematics as part of the *concrete–representational (visual)–abstract* (CRA) process. CRA has been advocated in research and by math organizations and leaders for several decades. The CRA process involves an initial introduction of a math concept using concrete objects, connecting these objects to visual models, and connecting both the concrete and visual models to abstract representations. As students’ understanding is developed, the concrete and visual representations are replaced by the abstract representations.

The primary conduit for connecting concrete representations to abstract representations is instruction that explicitly draws students’ attention to these connections. The IES Guide explains that by understanding the links between concrete and abstract representations, students have greater mastery of the principles being taught and are better able to transfer this knowledge “to other tasks that require students to use the same principle or concept” (p. 16).

### **Conclusion**

The conclusions from the IES Guide and from Hattie, Fisher, and Frey are well aligned in terms of identifying key influences in learning. Recommendations from both of these teams of educators and researchers overlap and complement each other. In the IES Guide *Organizing Instruction and Study to Improve Student Learning* and in *Visible Learning for Mathematics*, we find strong recommendations for spacing practice over time, interleaving worked examples, using visual aids, and connecting concrete, visual, and abstract representations of mathematical ideas.



In the winter *CORE Academic Quarterly* (available January 2018), part 2 of this article will compare the connections between recommendations 5, 6, and 7 from the IES Guide *Organizing Instruction and Study to Improve Student Learning* to recommendations in *Visible Learning for Mathematics*.

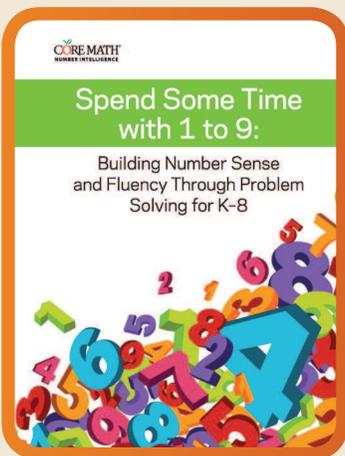
## Techniques for Effective Teaching May Age, but They Do Not Expire, Part 1 (cont.)

IES Guide (2017)		Hattie, Fisher, and Frey (2017)	
Recommendation	Level of Evidence	Influence	Effect Size
1. Space learning over time. <i>Arrange to review key elements of course content after a delay of several weeks to several months after initial presentation.</i>	Moderate	Spaced vs. massed practice	0.71
2. Interleave worked example solutions with problem-solving exercises. <i>Have students alternate between reading already worked solutions and trying to solve problems on their own.</i>	Moderate	Worked examples	0.57
3. Combine graphics with verbal descriptions. <i>Combine graphical presentations (e.g., graphs, figures) that illustrate key processes and procedures with verbal descriptions.</i>	Moderate	<i>Recommendations drawn from correspondence of multiple influences</i>	
4. Connect and integrate abstract and concrete representations of concepts. <i>Connect and integrate abstract representations of a concept with concrete representations of the same concept.</i>	Moderate	Manipulatives	0.50
5. Use quizzing to promote learning. <i>Use quizzing with active retrieval of information at all phases of the learning process to exploit the ability of retrieval directly to facilitate long-lasting memory traces.</i>	Low/Strong	Providing formative evaluation	0.90
		Feedback	0.75
6. Help students allocate study time efficiently. <i>Assist students in identifying what material they know well, and what needs further study, by teaching children how to judge what they have learned.</i>	Low	Self-reported grades/student expectations	1.44
		Metacognitive strategies	0.69
		Self-verbalization and self-questioning	0.64
7. Ask deep explanatory questions. <i>Use instructional prompts that encourage students to pose and answer “deep-level” questions on course material. These questions enable students to respond with explanations and supports deep understanding of taught material.</i>	Strong	Classroom discussion	0.82

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## Math Problem Corner



—From *Spend Some Time with 1 to 9* (CORE, 2014)

### Two Dimensions with 1 to 9 (Base, Height, and Area)

Rectangles can be different sizes. Use the numbers 1 to 9 as the base and height of a rectangle (length and width). The base and height must be different numbers.

Determine the areas of your rectangles. Find as many rectangles with areas such that the digits in the value for the area are only digits 1–9 (not zero) and are not the same as the digits used for the base and height.

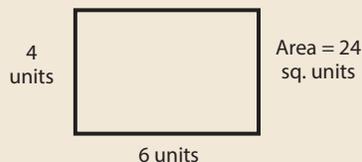
You may choose to draw the rectangles.

For example:

This rectangle is correct because the base, height, and area all have different digits.



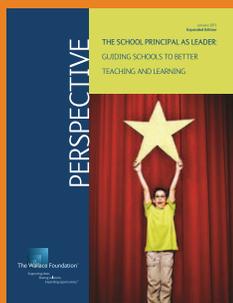
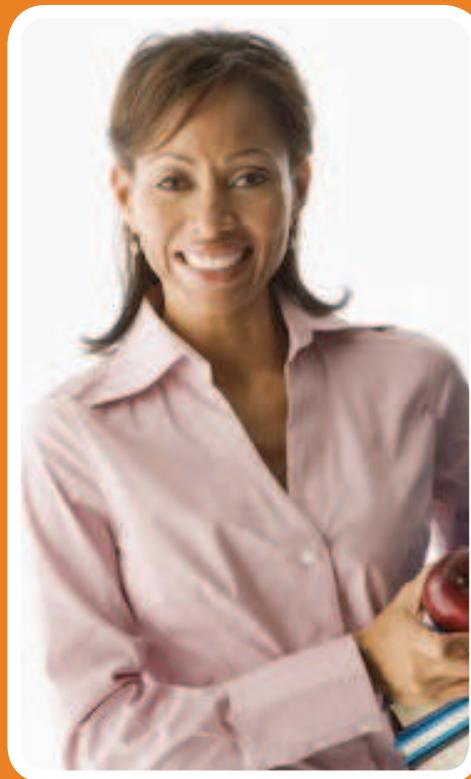
This rectangle is incorrect because the height and area both have the digit 4.



## CORE Leadership Corner: Wallace Webinars

The National Association of Elementary School Principals (NAESP) website features the Wallace Webinars under its Resources section. This series of webinars highlights the Wallace Foundation's five Key Practices found in *The School Principal as Leader: Guiding Schools to Better Teaching and Learning*. This report summarizes a decade of foundational research and work on school leadership, and identifies effective principal practices. These practices are applicable to both elementary and secondary principals.

You can find the series of webinars [here](#) and the full report [here](#).



### About CORE



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